To all whom it may concern:

Be it known that I, HENRY HOWARD, a
citizen of the United States, residing at
Brookline, in the county of Norfolk and
State of Massachusetts, have invented cer-
tain new and useful Improvements in
Processes of Making Carbon Dioxide and
Solid Sodium Sulfite, of which the follow-
ing is a specification.

This invention relates to a process of
making carbon dioxide and solid sodium sul-
fite, and is an improvement upon the process
described in my Patent No. 651,569, dated
June 12, 1900.

The object of my invention is to make
pure carbon dioxide from a suitable car-
bonate, such as sodium mono-carbonate,
sesqui-carbonate, or bicarbonate, or a mix-
ture of them, or from any other alkaline
or alkaline-earth carbonate, under condi-
tions which will give a solid sulfate salt
that may be used for other purposes, such as
the manufacture of bisulfite of soda, etc.

In carrying out this process a solid car-
bonate of soda, or of any other suitable base,
is added to a strong, preferably saturated,
solution of sodium bisulfite, or a bisulfite
of the base in the carbonate, in such quanti-
ties that carbon dioxide is liberated and a neu-
tral sulfate in the solid form is produced by the
reaction between them, as indicated by the
following reactions:

(solid) Na₂CO₃ + 2NaHSO₃ =
2Na₂SO₄ + CO₂ + H₂O.

With solid bicarbonate of soda:
(solid) NaHCO₃ + NaHSO₃ =
Na₂SO₄ + CO₂ + H₂O.

This reaction, with a solid sodium car-
bonate, produces neutral sodium sulfate in
such excess that it also separates from the so-
lution as a finely-divided solid sodium sulfate
suspended in a saturated solution of sodium
sulfite, and may be used in making solid
sodium disulfite according to the process
described in my prior Patent No. 1,084,436,
dated January 13, 1914. During the opera-
tion, it is preferable to heat the mixture to
drive out all the carbon dioxide, otherwise
some will remain dissolved in the solution
of sodium sulfate, and be lost.

In the accompanying drawing, which
illustrates a plant for carrying out the
process, a tank 1, provided with a valved
outlet 2, supplies a strong solution of bi-
sulfite to the bottom of the reaction tank 3;
a suitable carbonate is added to tank 3
through the air-lock manhole 4, and is kept
in suspension in the bisulfite solution by the
stirrer 5; the mixture of bisulfite and car-
bonate may be heated by the heating coil
6, if desired. The gas evolved by the re-
action passes out through the T-outlet pipe
7, and when the reaction is over, the result-
ing mass of solid sulfate of soda and its
saturated solution are removed through the
bottom outlet 8. The carbon dioxide may be
used as generated, or may be purified by
passing into a suitable scrubber 10 through
a perforated pipe 9. The scrubber prefer-
ably contains a solution of carbonate or bi-
carbonate of soda 11, which absorbs any
traces of sulfur-dioxide gas that may come
from the bisulfite in tank 3. A pump 12 ex-
hausts the dioxane from the reaction tank 3
direct by opening valve 13 and closing
valves 14 and 15; or through the scrubber
by closing valve 13 and opening valves
14 and 15.

I have shown the admission of bisulfite
solution to the bottom of the reaction tank
for the reason that bisulfites are not very
stable in solution, but tend to decompose on
slight heating, and on agitation. By intro-
ducing the bisulfite solution beneath the col-
umn of liquid containing the suspended car-
bonate, the bisulfite reacts upon the lower
strata of carbonate, the evolved gas passing
through the upper strata and in contact
with more carbonate, both dissolved and
suspended, whereby any sulfur dioxide will
be absorbed, liberating carbon dioxide and
forming neutral sulfate. The agitation of
the mass not only maintains the carbonate
and sulfate in suspension as above noted, but
also facilitates and accelerates the absorp-
tion.

In my prior Patent No. 651,569, above re-
ferred to, it is stated that dry sodium car-
bonate may be used as a source of carbon
dioxide, the bisulfite solution to which it is
added having sufficient water to dissolve it.
According to the present process, the same
reaction is employed but the water is pres-
et in restricted proportion to the reacting
bodies (bisulfite and carbonate) with the re-
sult that a portion of the neutral sulfate

UNITED STATES PATENT OFFICE.
HENRY HOWARD, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO GENERAL CHEMICAL
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PROCES OF MAKING CARBON DIOXID AND SODIUM SULFITE.


Original application filed March 6, 1913, Serial No. 752,281. Divided and this application filed November 22,
1915. Serial No. 69,700.
which is formed is obtained directly in solid form, the output of product from an apparatus of given size being correspondingly increased. The proportion of carbonate added is carefully controlled, as indicated by the foregoing equations, to avoid any excess above the amount required to yield the normal sulfite, for the reason that any such excess, whether in solution or in suspension, would contaminate the product (sulfite) if intended for commercial purposes, or would involve a corresponding loss of carbon dioxide in case the sulfite is treated with burner gases for re-conversion into bisulfite in accordance with my Patent No. 1,084,436, according to which the neutral sulfite solution containing undissolved sulfite is saturated with sulfur dioxide from burner gases or other suitable source, the resulting solid bisulfite removed, and the mother liquor utilized for the preparation of carbon dioxide.

I do not claim herein a process of making pure carbon dioxide and a solid normal sulfite in a single operation by reacting upon an aqueous solution of a bisulfite with a solid carbonate, the carbonate not in excess of the proportion required for the formation of normal sulfite, and the water in insufficient proportion for the complete solution of the normal sulfite formed; said subject-matter being claimed in my copending application Serial No. 752,331, filed March 6, 1913, whereof the present application is a division.

I claim:—

1. The process of producing carbon dioxide, comprising effecting a reaction between a soluble carbonate and a soluble bisulfite, thereby forming a normal sulfite and carbon dioxide, purifying the carbon dioxide from sulfur dioxide by causing the carbon dioxide to bubble through undecomposed carbonate maintained in mechanical suspension in a liquid, said liquid in insufficient proportion for the solution of the carbonate, and collecting the substantially pure carbon dioxide.

2. The process of producing carbon dioxide, comprising effecting a reaction between sodium carbonate and dissolved sodium bisulfite, thereby forming normal sodium sulfite and carbon dioxide, purifying the carbon dioxide from sulfur dioxide by causing the carbon dioxide to bubble through sodium carbonate maintained in mechanical suspension in the liquid, said liquid in insufficient proportion for the solution of the carbonate1106

3. In a process of producing carbon dioxide by a reaction between sodium carbonate and dissolved sodium bisulfite, the step which consists in introducing the bisulfite solution beneath the surface of a column of liquid carrying sodium carbonate mechanically suspended therein, said liquid in insufficient proportion for the solution of the carbonate.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY HOWARD.

Witnesses:

I. M. GRAHAM,
M. V. O'BREEN.